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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports\*  
for

SOIL CONSERVATION SERVICE RESEARCH\*\*

FEBRUARY 1947

EROSION CONTROL PRACTICES DIVISION

Soil Moisture as-Affected by Sweet Clover Residue Treatments - Hugh C. McKay, St. Anthony, Idaho.-"The moisture data taken in 1946 on the sweet clover residue treatment plots is not too consistent but it does give an idea of the amount of moisture left in the soil from the various practices. One crop of wheat has been grown on these plots since the sweet clover was plowed down. The soil samples were taken in the fallow year following the wheat crop. The following table gives the percent moisture for the different methods.

Average percent moisture to a 6 foot depth for various sweet clover treatments. Moldboard plow.

Height of Plowing down sweet clover	Percent Moisture	
	Spring, 2nd fallow year	Fall, 2nd fallow year
12" - 14"	13.0	15.7
20" - 22"	13.0	12.4
34" - 36"	11.6	13.0

"The above data shows that even in the spring of the second fallow year the moisture on the plots where the sweet clover was allowed to grow to 34-36" had not come up to the percent moisture in the other plots. In the fall the plots were more nearly equalized except for the first date of plowing which had the largest increase in moisture."

Stretching Irrigation Water in Citrus Orchards - Joel E. Fletcher, Tucson, Arizona.-"In view of the limited water allotment for 1947, irrigation data were examined in an effort to detect what method of water application would result in the least damage to citrus trees. During the past two years indications are that an alternate irrigation of one side of a row for one irrigation and the opposite side in the following irrigation, gave yields of fruit 10% to 15% higher than where the same total amount of water was added to both sides of the tree at once. It appears that such a program reduces luxury transpiration to a minimum."

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\*\*All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

Micro-Aggregation Determinations On Samples Of Soil From The Potato Rotation Plots - Sterling J. Richards, New Brunswick, New Jersey.-"The results are shown in the following table as the percent of silt and clay fractions remaining in aggregates larger than silt particles after mildly stirring in a water suspension. The samples were stored after being air dried and screened through a 2 mm. sieve.

Plot No.	8	9	10	11	12
Sampling Date	Percent Aggregation of Silt and Clay				
March 23, 1946	29	38	36	35	27
Crop - 1945	Potatoes	Wheat	Wheat	Clover	Potatoes
November 1, 1946	19	28	21	10	14
Crop - 1946	Wheat	Clover	Potatoes	Potatoes	Potatoes

"The aggregation is higher for the samples taken March 23, 1946. This may have been caused by the longer storage period. The relative aggregation seems to show that wheat promotes aggregation about as well as clover and its effects are more lasting."

Effect of Tillage, Contour Cultivation and Terraces on Runoff Water from Deep Permeable Soil on the Wheatland Conservation Experiment Station, Cherokee, Oklahoma 1/ - Harley A. Daniel, Guthrie, Oklahoma.-

"The effect of contour cultivation and terraces on the conservation of runoff water and crop yields is being measured at the Cherokee station. The results given in the following table show that where all cultivation was conducted with the slope the lowest amount of runoff was from the mulch plots and the highest from the listed. During heavy rains the dams in the furrows of the plots basin listed with the slope often broke and this may account for the runoff being higher from these plots than that from the plowed land. But both listing and basin listing greatly reduced runoff water losses when conducted on the contour. In fact, during the last five years contour cultivation reduced the average amount of runoff from the four methods of tillage 22.7 percent. Even though this is an outstanding saving of moisture, observations on the watersheds show that contour cultivation alone is not sufficient to control erosion on land slopes over 1.5 percent. During the same period, however, a combination of terraces and contour cultivation conserved an average of 42.5 percent more water than land cultivated with the slope.

"The first and second years after these terraces were built, the yield of wheat on the terraced and contour cultivated plots was less than that from those cultivated with the slope. But the results given in the following table show that beginning with the third year, apparently after nature had time to adjust soil conditions in the disturbed portion of the ridges and



TABLE 1

Method of Tillage	Percent Runoff				
	With Slope	Contour	Saved by Contouring	Terraces and Contour <sup>2/</sup>	Saved by Terracing & Contouring
Stubble mulch	12.9	11.9	7.7	7.6	41.1
Plowed	13.8	12.6	8.7	8.2	40.6
Listed	15.2	10.3	32.2	8.9	41.4
Basin Listed	14.5	8.8	39.3	7.8	46.2
Average	14.1	10.9	22.7	8.1	42.5

1/ Results for crop year (July 1 to June 30). Five year average 1942-46. Average annual rainfall 25.70 inches.

2/ Short level terraces with one end open.

channel, the yields have been higher on the terraced and contour cultivated plots. Although the rainfall for the 1945 crop year was well distributed and 8.6 inches above normal, terraces and contour cultivation increased the yield an average of 1.3 bushels per acre. With the exception of the first year, contour cultivation alone also increased crop yields.

TABLE 2

Year	Bushels of Wheat per Acre					Precipitation	
	With Slope	Contour	Difference by Contouring	Terrace and Contour <sup>2/</sup>	Difference by Terracing & Contouring	Total Annual Inches	Departure from Average Inches <sup>3/</sup>
1942	16.0	15.5	- 0.5	14.1	- 1.9	30.0	- 4.4
1943	9.2	9.9	0.7	8.0	- 1.2	20.3	- 5.6
1944	17.7	19.2	1.5	19.4	1.7	20.4	- 5.5
1945	23.2	24.6	1.4	24.5	1.3	34.3	8.6
1946	21.0	24.0	3.0	23.8	2.8	23.7	- 2.1
Average	17.4	18.6	1.2	19.0	0.6	25.7	- 0.2

1/ Data compiled from averages of stubble mulch, plowed, listed and basin listed plots.

2/ Short level terraces one end open.

3/ Based on Weather Bureau record in Cherokee, Oklahoma, since 1915.

Crop Yields in Relation to Tillage Practices at Owen, Wisconsin - O. E. Hays, LaCrosse, Wisconsin.-"The work to date was reviewed by various technicians who have been associated with the Owen project. Dr. Muckenhirn presented the following yield data from the contour and up-and-down hill plots. The soil is Almena silt loam, a very poorly drained soil, located on a three percent slope.

Average Crop Yields by Methods of Tillage (1944, 1945 and 1946)

Tillage	Corn*	Oats	Corn Silage	1st Yr. Hay	Oats Straw
	(Bushels Per Acre)		(Tons Per Acre)		
Up-and-down hill	36.6	55.3	8.5	3.7	1.2
Contour	37.7	56.0	8.9	3.8	1.1
Contour and terrace	34.8	67.1**	8.6	3.9	1.4

\* Includes considerable soft corn in 1945 and 1946 when early frosts occurred.

\*\* No oats grown in 1946 so average is for two years only. If all three years were represented, average yield would probably be no higher than with other tillage treatments.

"The three years of data available would indicate that, for the climatic conditions sampled, yield of corn is not greatly influenced by direction of row. More years of data will need to be collected before definite trends can be shown."

Handbook for County Agents - Bruno Klinger, Fort Collins, Colorado.-"By request of the Colorado Experiment Station and Extension Service, the project supervisor worked with representatives of these agencies and of federal services preparing a handbook for county agents of the State. The agents held their annual meeting in Fort Collins from February 21 to 28, inclusive. The greater part of our time spent on the handbook was devoted to sections on mountain meadow improvement, revegetation, and range conservation. In the process of preparing a much condensed final draft, a large amount of material was organized by the various committees participating. Means are now being sought of making this material available to workers in technical fields who very much want the information at hand for ready reference."

Earthworms - H. O. Hill, Temple, Texas.-"Earthworms evidently find that hubam clover residue produces a richer and more desirable soil in which to live and reproduce. In preparing corn plots this spring, it was observed that many earthworms, both young and old, were present in the areas where clover was grown last year, and that there were very few after corn."

Winter Protection for Earthworms Benefits Soil Structure on Cultivated Land - Henry Hopp, Beltsville, Maryland.-"Last month we reported that the decline in earthworm population on cultivated land occurred at the time of the first winter freeze and that this decline can be avoided by a protective cover in the late fall. The effect on soil aggregation has now been measured in six plots, with the following results:

Plot and 1946 Crop	Type of Surface Protection	Water-Stable Aggregates (Percent)	
		Unprotected	Protected
Corn	Burlap	15	25
Corn	Lespedeza straw	10	27
Soybeans	Soybean residue	11	43
Strawberries	Straw	16	33
Strawberries	Straw	12	16
Peaches (heavy organic matter applications)	Mixed hay	51	65

(Aggregate analyses made by Jay C. Bryant)

"These data suggest a possible way of correcting the losses in structure that occur in some soils with continuous cultivation."

Effect of Aeration on Bacterial Activity and Soil Structure - D. S. Hubbell, State College, New Mexico.-"Work was continued during the month on the effect of aeration on bacterial activity and soil structure. The first series which were incubated for a period of 30 days indicate that aeration has a definite effect on both bacterial numbers and total percentage of aggregation. The next series which involves treatments with varying amounts of air will be incubated for a 60-day period."

Response of Hubam Clover to Phosphate and Phosphate Placement - H. O. Hill, Temple, Texas.-"A legume experiment studying the depth of phosphate application and the rate and placement of inoculation has been completed by Dr. Johnston. Either the inoculum was dead or the soil used was already inoculated with the correct bacteria for hubam. All of the pots showed approximately the same amount of nodulation. This reduced the study to that of considering the effect of phosphate versus none and phosphate on the surface as compared with phosphate two inches below the seed. A summary of the data are given in the following table.

"An inspection of the hubam pot experiment shows that 25 pounds of  $P_2O_5$  per acre near the surface in contact with the clover seed increased the yield of dry matter 100%. When the same rate of application was applied in the zone of root activity two inches below the seed, the yield of dry matter over no phosphate was increased 200%. The application of the phosphate increased the phosphorous content of the tops about 13% even though the treatment also increased the yield of dry matter. The yield of dry matter in the roots is similar to the dry matter yield of tops. The phosphorous content of the treated root material was not as high in proportion as the treated top material.



Summary of dry matter, nitrogen, and phosphorous contents of hubam in pot experiment.

Inoculum	Phosphate	TOPS			ROOTS		
		Dry Matter	Nitrogen	Phosphorous	Dry Matter	Nitrogen	Phosphorous
On Seed	Lbs. $P_2O_5/A$ None	Gms/pot 3.3	% 3.11	% 0.153	Gms/pot 2.6	% 2.46	% 0.130
On Seed	25 lbs. in contact with seed	6.1	3.19	.177	4.0	2.63	.147
2" below Seed	None	3.5	3.39	.154	2.5	2.39	.143
2" below Seed	25 lbs. 2" below seed	9.8	3.04	.176	5.0	2.59	.144

Costs and Benefits of Conservation - Madison-St. Clair Counties-Comparisons for Seven-Year Average, 1939-1945 - E. L. Sauer, Urbana, Illinois.

"Farm account records were available on the identical 48 farms in Madison and St. Clair counties for the seven-year period 1939-1945. In 1939 at the start of this seven-year period, the two groups of farms with high conservation scores and low conservation scores were almost identical in productivity and in earnings, having crop yield indices of 100.2 and 99.7, respectively, and net incomes per acre of \$9.87 and \$9.84, respectively. Since then the 24 farms with high conservation scores have adopted conservation programs. Land use on the two groups of farms differed but little for the seven-year period, although the farms with high conservation scores averaged slightly more legume pasture. The crop yields as measured by the crop yield index averaged six points higher on the farms with high conservation scores. Livestock production also averaged higher on the farms with high conservation scores. Source of income was practically the same for the two groups of farms. Over the seven-year period the farms with high conservation scores had an average gross income per acre of \$4.72 more than the farms with low conservation scores. Conservation expenses averaged 4.9 percent of the gross income on the farms with high conservation scores and 3.4 percent of the gross income on the farms with low conservation scores. Net farm income per acre averaged \$13.88 for the farms with high conservation scores and \$9.56 for the farms with low conservation scores, an annual difference of \$4.32 per acre in net income and a total difference for the seven-year period of \$30.24 per acre in favor of the farms with the high conservation scores."

Cost and Benefits of Conservation on Northeastern Illinois Slowly Permeable Till Soils - "Slowly permeable till soils are found in 18 counties of Northeastern Illinois. This analysis is based on data for 1945 from five of these counties--Ford, Iroquois, Livingston, Vermilion, and Will. The 80



farms used in this study included 40 farms having predominately Clarence-Rowe soils and 40 farms having mixed Clarence-Swygert-Elliott soils. These two groups were subdivided on the basis of high and low conservation scores.

"The farms were classified into high and low conservation score farms on the basis of limestone and phosphate applications to date and on the basis of rotations followed, percent of land in legumes, and application of specific conservation practices such as contouring, grass waterways, and drainage. The high score farms were paired with the low score farms on the basis of data from county soil maps, detailed soil conservation survey maps in a few instances, the knowledge of the farmers, the farm adviser, and the local conservationist, and the following other factors: (1) acres per farm, (2) percent of farm tillable, (3) land value per acre.

"The higher percentage of land in legumes and higher expenditures for conservation on the high conservation score farms contributed toward the higher yields, higher production, and higher net income per acre compared with the farms with low scores. As the percent of land in legumes increased, crop yields tended to increase. Net farm incomes tended to increase with increasing proportions of land in legumes. The farms with high conservation scores had a higher proportion of income from livestock and a lower proportion from crops. Production of total digestible nutrients per acre and units of livestock production as measured by pounds of meat or 10 pound milk per acre tended to increase as the percent of land in legumes increased. Income per acre tended to increase as conservation expenses per acre increased. Adjacent farms exhibit wide variations--on a high conservation farm on Clarence-Rowe soils, where limestone and phosphate has been applied and a three-year rotation is used, corn grown on the contour yielded 55 bushels per acre in 1945--on an adjoining farm where no soil treatment or conservation practices have been applied and a heavy grain cropping program has been followed for the past 40 years, corn yielded only 12 bushels per acre in 1945. Improved permanent pastures on this high score farm returned \$11.00 an acre compared to a zero return for permanent pastures on the adjoining low conservation score farm."

Cost and Benefits of Conservation - McLean County - "The farms with high conservation scores are growing larger acreages of deep-rooted legumes and have a smaller proportion of their land in soybeans. Corn yields in 1945 averaged 6.5 bushels per acre higher on the farms with high conservation scores, oats yields, 4.6 bushels per acre higher and soybeans, 3.8 bushels higher. The farms with high conservation scores produced 45 tons more grain per farm and 147 pounds more of total digestible nutrients per acre than the farms with low conservation scores.

"Power and machinery costs and man labor costs per crop acre were lower and total farm expenses per acre averaged \$1.89 less on the farms with high conservation scores. Farming on the contour and use of other special erosion control practices evidently did not result in higher total farm expenses or higher operating expenses per acre on these farms.

"Long-Time Comparisons. In 1936 the farms with high conservation scores (scores based on degree of conservation by 1945) had a crop yield index of 97 and a net income of \$5.78 per acre, compared to 103 and \$6.54, respectively, for the farms with low scores. In 1945, they had a crop yield index of 106 and a net income of \$27.51 per acre, compared to 94 and \$22.64, respectively, for the farms with low scores.

"At 1945 price levels a McLean County high conservation farm of 160 acres would have earned \$779 more than a low conservation farm. Annual conservation costs in 1945 on an 160 acre high conservation McLean County farm would have been \$76 higher than on a low conservation farm."

Paying Dividends out of Capital in the Vineyard - E. A. Carleton, Geneva, New York.-"As mentioned in our annual report, near Brockton, New York, Charles Flagg and Professor Nelson Shaulis located a Concord vineyard with rows up and down hill, with another just across a field road with rows on the contour. Both vineyards were reasonably comparable as to age and management. The organic matter determinations were completed and reported as follows:

Rows up and down slope				
Position on slope	Past erosion	Soil organic matter content	Grape Yield per vine	Vines missing in area
		Per cent	Pounds	Per cent
Top	Very severe	0.89	2.5	25
Middle	Severe	1.20	5.1	0
Bottom	Slight	2.06	6.5	11
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Rows on contour				
Top	Severe	0.98	5.5	0
Middle	Moderate	1.73	8.2	0
Bottom	Slight	2.06	10.3	8

"There are several points of interest here. First, this is a deep, gravelly soil, high in productivity. We would hardly expect erosion to do as serious damage here as in the case of most other soils. Second, probably considerable erosion had occurred before the contour vineyard was planted. However, the contour rows seem to be paying a dividend in higher yields due to saving water and slowing down erosion."

Grazing Studies - C. J. Whitfield, Amarillo, Texas.-"During the 90-day period, December 1, 1946 to March 1, 1947, steers wintered on wheat with dry roughage gained 129.5, or an average daily gain of 1.44 pounds, while steers on grass with two pounds of cake daily gained 133.0 pounds, or 1.48 daily. This is a reversal of data secured during the past two years in which calves on wheat outgained the grass calves. Wheat forage production has been at a low ebb during the winter due to drought and freezing weather. On the other hand, the gains of the grass steers have been above average in spite of the existing conditions. For example, during the winter of 1945-46, gains were as follows: December .60, January 1.1, and February .29. In 1946-47, the gains were December 1.7, January 1.5, and February 1.1. Better conditions for beef production at the present are probably due to heavy fall moisture with mild weather conditions, leaving the forage, though short, highly nutritious.

"All pastures lost moisture during the winter. Total available moisture present in February is as follows:

Blue grama - buffalo (moderately used)	4.08
Blue grama - buffalo (heavily used)	3.36
Seeded western wheatgrass	2.23
Seeded crested wheatgrass	2.89

The effect of crop rotations, residues and manure on the yield of corn, Experiment VI, Marshall silt loam, Clarinda, Iowa 1940-46. G. M. Browning, Ames, Iowa.-

Rotation	Residue	1946*	Average**		
			1st yr. corn	2nd yr. corn	3rd yr. corn
Corn-Corn-Corn-Oats	3 T/A manure to 1st yr. corn	36.8	74.4	60.2	42.2
Corn-Corn-Corn-Oats	3 T/A straw plus N to 1st yr. corn	33.2	82.4	64.4	41.6
Corn-Corn-Corn-Oats	3 T/A matured sweet clover	36.0	83.0	61.8	40.4
Corn-Oats		63.0	66.3		
" "	Cornstalks burned	60.8	66.0	-	-
" "	3 T straw plus N to 1st yr. corn	76.3	82.8	-	-
" " (SwCl)	Straw removed	87.8	88.4	-	-
" " (SwCl)	Straw returned	75.0	83.4	-	-
Meadow-Meadow-Corn-Oats		108.4	101.0	-	-



Difference for significance 13.4 bu/A

- \* In the Corn-Corn-Corn-Oats rotations the 1946 crop is third year corn.  
 \*\* The Corn-Corn-Corn-Oats and Meadow-Meadow-Corn-Oats average is from two rounds of the rotation; the Corn-Oats average is from four rounds of the rotation.

The effect of crop rotation on yield of corn, Experiment IX, Marshall silt loam, Clarinda, Iowa 1943-46.-

Rotation No.	Crop Rotation	Yield of Corn bu/A	Increase bu/A
I	Corn (cover crop)	74.1	-
III	Corn, Soybeans	81.9	7.8
II	Corn, Oats (Sweet Clover)	90.7	16.6
V	Corn, Oats, Meadow	92.8	18.7
VI	Corn, Oats, Meadow, Meadow	87.6	13.5
IX	Corn, Soybeans, Oats, Meadow	92.6	18.5

The yield of first and second year corn following meadow or sweet clover, Experiment IV, Marshall silt loam, Clarinda, Iowa 1943-46 -

Crop Rotation	Yield of Corn - bu/A			Stand. - plants/A		
	1st yr.	2nd yr.	Diff.	1st yr.	2nd yr.	Diff.
Corn, Corn, Oats (Sweet Clover)	86.6	72.2	14.4	9267	8082	1185
Corn, Corn, Oats, Meadow	92.5	71.4	21.1	9110	8062	1048
Corn, Corn, Oats, Meadow, Meadow	87.7	74.2	13.5	9097	8477	620
Corn, Corn, Soybeans, Oats (SwCl Catch)	88.5	69.9	18.6	8845	8014	831
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Average	88.8	71.9	16.9	9080	8159	921
% increase 1st yr. over 2nd yr.	-	-	23.5	-	-	11.3



The effect of crop rotations on the yield of corn, Experiment IX,  
Marshall silt loam, Clarinda Experimental Farm\* -

Rotation	Cropping System	1946		Ave. 1943-1946	
		Yield bu/A	Stand plants/A	Yield bu/A	Stand plants/A
I	Continuous Corn (SwCl cover crop)	82.5	9920	74.1	8504
II	Corn, Oats (SwCl for green manure).	98.8	10710	90.7	9294
III	Corn, Soybeans	82.1	10247	81.9	8545
IV	Corn, Corn, Oats (SwCl for green manure)				
	First Year Corn	89.6	10520	86.6	9267
	Second Year Corn	78.3	9947	72.2	8082
V	Corn, Oats, Meadow	111.5	9593	92.8	9240
VI	Corn, Oats, Meadow, Meadow	95.9	9457	87.6	8716
VII	Corn, Corn, Oats, Meadow				
	First Year Corn	106.6	10874	92.5	9110
	Second Year Corn	81.9	9866	71.4	8062
VIII	Corn, Corn, Oats, Meadow, Meadow				
	First Year Corn	97.1	10138	87.7	9097
	Second Year Corn	86.0	10710	74.2	8477
IX	Corn, Soybeans, Oats, Meadow	103.6	10738	92.6	9424
X	Corn, Corn, Soybeans, Oats (SwCl green manure)				
	First Year Corn	96.7	10302	88.5	8845
	Second Year Corn	80.5	10002	69.9	8014
Difference required for significance		12.1	1732	6.5	685

\*Data represent the average of triplicate plots.

Summary of effect of tillage practices on yield of corn, Western Iowa, 1944-46.

Soil Type	No. of Fields	Yield of Corn bu/A							
		No Fertilizers				167lb/A of 3-12-12			
		Flow- ed	Hard Ground Listed	Subsur- face Tilled	Disk- ed	Flow- ed	Hard Ground Listed	Subsur- face Tilled	Disk- ed
Marshall silt loam	13	79.8	73.4	71.1	73.6	81.7	77.0	75.3	77.0
Monona silt loam	4	72.0	72.3	72.1	67.4	72.4	75.5	74.6	69.0
Ida silt loam	4	62.5	58.7	58.9	59.5	65.9	68.4	64.0	61.9
Marcus silt loam	1	75.8	72.6	62.8	69.4	85.3	74.0	66.7	62.4
LaMoure silt loam	1	80.7	66.4	83.6	57.3	87.6	77.2	83.1	68.3
Average	23	75.3	70.1	69.4	69.2	77.9	75.4	72.8	72.0

The effect of tillage practices on corn yields and stand of Marshall, Monona and Ida soils, 1944-46\* -

Tillage Method	Yield - bu/A -	Stand - plants/A
Flowed	76.2	9268
Hard ground listed	73.2	8979
Subsurface tilled	69.7	9228
Subsurface tilled and disked	69.2	9436
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Difference required for significance	2.2	197

\*These figures represent the average of 23 fields on Marshall, 4 fields on Ida and 4 fields on Monona soil. There were 6 fields in 1944; 15 fields in 1945 and 10 fields in 1946.

Summary of the effect of fertilizer and side dressing with nitrogen on yield of corn in Western, Iowa,  
1945-1946\*

Soil Type	Yield of Corn bu/A											
	No Fertilizer	167 <sup>1/2</sup> /A	3-12-12	40 <sup>1/2</sup> /A	Nitrogen	167 <sup>1/2</sup> /A	3-12-12	40 <sup>1/2</sup> /A	N			
	P : HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P	HL : SS : SSD: P
Marshall Silt Loam	:81.0:70.6:68.8:69.3:79.5:75.1:71.7:70.9:83.8:75.1:73.9:73.9:85.9:	:	:	:	:	:	:	:	:	:	:	:
Marcus Silt Loam	:75.8:72.6:62.8:69.4:85.3:74.0:66.7:62.4:86.4:79.5:59.0:63.8:78.0:	:	:	:	:	:	:	:	:	:	:	:
LaMoire Silt Loam	:80.7:66.4:83.6:57.3:87.6:77.2:83.1:68.3:90.8:77.4:88.2:72.4:94.2:	:	:	:	:	:	:	:	:	:	:	:
Ida Silt Loam	:35.0:48.1:45.3:43.2:42.6:59.1:54.0:59.1:38.2:63.2:52.1:54.2:52.0:	:	:	:	:	:	:	:	:	:	:	:
Average - 9 fields	:75.3:67.9:67.1:65.4:76.9:73.4:70.4:68.4:79.8:74.5:71.4:70.4:82.2:	:	:	:	:	:	:	:	:	:	:	:
	:71.5:	:	:	:	:	:	:	:	:	:	:	:

\* Represents 1 field each on Marshall and Ida in 1945: 5 fields on Marshall in 1946 and 1 field each on Marcus and LaMoire in 1946.

- P = Plowed
- HL = Hard-ground Listed
- SS = Subsurface tilled
- SSD = Subsurface Tilled and Disked

## DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.--"Frost conditions were observed on the mulched plots (plots plowed and disked for corn in April 1946). Three types of frost structures were found on these plots which are now in wheat. The concrete type is characterized by a very dense complex of small ice crystals and soil and is rather impervious. The honeycomb and stalactite structures have more air space, larger ice crystals, and are more pervious. An interesting observation made was that on the plowed plots, 5 inches of frost was found, all of the concrete type. On the disked plots, the upper half consisted of the honeycomb and stalactite while only the lower half consisted of the concrete. The great amount of litter and plant residue in the upper 2 inches of the disked soils may be the major factor in producing the more porous type of frost structure."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.--"The eccentric disk used for pasture rennovation was received from the McCook, Nebraska District. This equipment consists of a one-way disk plow which has been altered so that the disks are set off center and has been used in Wyoming for pasture rennovation with considerable success. Two of our pasture plots will be treated as soon as the frost leaves the ground this spring."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.--"Laboratory determinations of soil and fertility contents were completed for runoff samples collected in January. While the soil and nutrient losses were all low, those from fallow and wheat watersheds under the prevailing treatment were many times those from the corresponding watersheds under the conservation treatment. Of the prevailing treated watersheds, those in wheat (bean straw disked into surface) lost about twice as much soil as the fallow watersheds on which the corn stalks had been broken over early in the winter."

"The crop utilization of water retained by reduced runoff from the conservation treated watersheds is planned for study beginning this coming season. In this connection plans were made and work started on a field sampling of the 'field capacities' of soil on the experiment watersheds. Small plots within watersheds to be in corn next year have been mulched to induce rainfall penetration and reduce runoff and evaporation during the March and April rains. The plots will then be covered with waterproof paper to prevent evaporation and sampled for moisture content at several depths until equilibrium is reached."

Hydrologic Studies - R. G. White, East Lansing, Michigan.--"There was only one period of runoff during the month. This started on February 14 and ended on February 17. The total runoff for watershed 'A' was 0.0623 inch, and for watershed 'B' it was 0.0595 inch. There was only a



"At the beginning of February the ground was frozen to a depth of 6 inches under brome-alfalfa sod, and 18 inches under the rye winter cover. There was no frozen soil at any time during the month at the wooded watershed. The difference in the depth of frost under the brome-alfalfa sod and under the rye winter cover crop is due primarily to difference in depth of snow cover caused by the difference in vegetation. Snow depth on the brome-alfalfa sod varied from 5 to 7 inches during the month, while on the rye it varied from 4 to 5 inches."

Hydrologic Studies - R. W. Baird, Waco, Texas.-"The Regional Research Liaison Committee spent the day, February 27th, at the Project. They were much interested in the work being done. Items that seemed of particular interest, in addition to the runoff and soil loss data, were the work planned on control of injurious insects in cooperation with the Bureau of Entomology and Plant Quarantine, the effect of certain fertilizer treatments on meadow and pasture land, and the general effect of conservation practices on crop yields. They suggested that as possible additional runoff stations be re-established, some soil moisture studies be conducted, and that additional work be done on the effect of fertilizers and legumes. In as far as possible with present funds this work will be done. They also suggested that the cropping plan be adjusted to conform with the recommendations of the McLennan County Soil Conservation District. The present plan has been used with little change since it was established in 1942 and the changes will be worked out and included in the 1948 crop plan.

"Plans and arrangements have been made to use some Benzene hexachloride for control of wireworms in corn fields this year. As soon as field conditions permit this insecticide will be applied. Material has been made available to treat approximately half of the area to be planted to corn this year."

Hydrologic Studies - John Lamb, Jr., Ithaca, New York.-"Due to the small number of low-producing storms, mostly in the form of snow, precipitation was 1-inch below the station 12-year average. Consistent low temperatures prevailed throughout the month with resulting trace of runoff. On the 13th, the idle-land area had a 4-inch cover of granular snow causing frost to develop to a 1-inch depth. Continued low temperatures with little added snow cover caused freezing to 7 inches by the 24th. For the 13th, the woodland area had a 6-inch cover of snow with soil not frozen, and on the 24th an 8-inch cover with the leaf litter only frozen. As usual, the month of February ran true to form in lows for both water yield and thermal units."

Runoff Studies - T. W. Edminster, Blacksburg, Virginia.-

"Considerable time was spent in the construction and modification of a stubble mulch plow that is designed to overcome some of the problems met with during previous years. This plow is incorporating the principles of the pulverator or rotary moldboard principle together with certain modified deep tillage equipment mounted below the plow bottom. Work was also carried out on the construction of the deep lime placement equipment that is to be used in cooperation with the Agronomy Department and the Virginia Truck Station in certain cooperative work for which a work plan has not been fully developed."

Hydrologic Studies - F. W. Blaisdell, Minneapolis, Minnesota.-

"Mr. Anderson completed the plans for a new set-up of the pipe drop inlet culvert experiment in which the pipe is being lengthened from 20 diameters to 100 diameters in order to measure the total head loss which originates in the riser and at its junction with the pipe. The previous model set-ups were dismantled and construction of the new set-up begun. The set-up was largely complete at the end of the month. Work remaining before testing can be resumed includes the construction and installation of the models and manometers."

"Mr. Donnelly continued the exploratory submergence tests of the box inlet drop spillway. The box inlet dimensions and the discharge were constant for all tests made during the month. Different submergence curves were obtained for each of the several flares tested, indicating that the influence of the outlet on the submergence will have to be investigated. This will multiply the time required for making the study. Tests were run with no basin, and it was discovered that the basin helps to reduce the effect of submergence. Two tests were also made with a very long straight section between the drop inlet and the spillway basin. The effect of the lengthened straight section on the submergence curve was so small that it could not be detected.

"In the latter part of January Mr. C. J. Francis, Chief of the Region 5 Engineering Division, requested information on the hydraulics of a proposed corrugated pipe drop structure for use in irrigation ditches on Case-Wheeler projects. In order to give Mr. Francis a positive and accurate answer to his question, the model being tested in cooperation with the Minnesota Department of Conservation and the Northwestern Division of Armco Metal Products, Incorporated was remodeled to the design submitted. The tests showed that while the structure had the desired capacity, unanticipated, serious scour occurred at the inlet, and the scour at the outlet was bad, even though it did not undermine the pipe. However, the eroded material was deposited in the downstream channel where it will cause a maintenance problem to irrigators. It seems likely that the removal of the deposited material cannot be deferred until slack seasons but will have to be carried out during the busy irrigation period. Plans were made for an engineer from the Region 5 Engineering Division to view the model in operation early in March."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"A study was started on the 'trickle' problem. This is the problem of small flows of long duration in terrace outlet channels. The possibility of using grasses adapted to moist conditions was discussed at considerable length with Professor Hi Staten of the Oklahoma Agricultural Experiment Station. Most of the grasses proposed are winter grasses and cannot be planted until the fall. Also considered is the experimenting with a small concrete trickle channel in the bed of a larger vegetal channel. Comments on the 'trickle' problem from other observers are invited.

Some of the principal conclusions from the 1946 Annual Report are:

1. Vegetations of similar physical characteristics have a similar flow retarding characteristics. Similarity in length seems to be of greatest importance.
2. Four relationships of Manning's  $n$  to VR (product of mean velocity and hydraulic radius) have been selected that represent four different degrees of vegetal retardance. These have been designated as retardance groups A, B, C, and D with A being the group of highest retardance and D the lowest.



3. The selection of the four retardance groups enabled the preparation of four design diagrams which solve Manning's formula for a wide range of vegetal channel conditions.
4. The  $n$ -VR relationship holds for conditions of non-uniform flow.
5. Values of Manning's  $n$  for a channel are greater for decelerated flows than for uniform or accelerated flows, other conditions being equal.
6. Vegetation helps protect a channel bed from scour by reducing velocities near the bed.
7. A bad break in the completeness of the vegetal cover in a channel may reduce permissible velocities by as much as one-half.
8. Soil texture has considerable effect on permissible velocity. Changing the bed soil texture in a Bermuda lined channel from a silt loam to a fine sand reduced the permissible velocity from 8 feet per second to 3 feet per second."

Sedimentation Studies - L. C. Gottschalk, Washington, D. C.-

"Additional analyses were made of data obtained in June 1945 from sedimentation surveys of 18 LU-SD-2 stock ponds near Pierre, South Dakota, in an attempt to determine the effect of sediment accumulation on trap efficiency of these ponds and to develop, if possible, statistical procedure for analyzing existing reservoir-sedimentation data for other parts of the country. The analyses included multiple linear and curvilinear regressions, including the compound discount formula which reasoning indicated might explain the rate of sediment accumulation in the ponds. No improvement was found in the form of the linear regression formula which was developed during the original analyses of these data and presented in a paper at the May 1946 meeting of the American Geophysical Union. Certain expected relationships which affect trap efficiency of reservoirs were undeterminable in this set of data because of insufficient variation in the ages of the ponds.

"During the month considerable work was done in cooperation with representatives of the U. S. Geological Survey, the Bureau of Reclamation, and the Corps of Engineers on revising and editing a preliminary inventory of existing data and current programs of sediment-load sampling of streams. During this period arrangements were made also for the transfer of funds from the Bureau of Reclamation to the Soil Conservation Service to offset costs of assembling, editing, and printing a limited number of copies of an annotated bibliography on sedimentation from material now in the files of the Sedimentation Section. Both of these jobs are being done under the sponsorship of the Federal Inter-Agency River Basin Committee's Subcommittee on Sedimentation."



Sediment Studies - Vito A. Vanoni, Cooperative Laboratory, California Institute of Technology, Pasadena, California.-"Two experiments were completed in the 33-inch flume, one with a water depth of about 0.6 foot and the other of 0.3 foot. The results with the greater depth and hence the higher transporting capacity gave the usual sediment-distribution curves with concentrations decreasing with distance from the bed. With the lesser depth the sediment distribution curves were very erratic. In some cases the sediment concentration actually seemed to increase with distance from the bed, although the concentrations were very low. The water in these experiments is kept clean and therefore the movement of the sediment on the bed can be studied visually. This gives an opportunity to learn more about this important problem."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"Moisture readings for period indicate that during extended period of low rainfall it takes quite a while, or quite a bit of rain, to actually penetrate the mulching materials and increase the moisture content of the underlying materials. That is, mulch materials help to conserve moisture but after a period of low rainfall the mulch materials will absorb a certain amount of moisture before the moisture content of the soil material will be raised. Therefore, during such period the mulch material might actually absorb low rainfall preventing it from reaching the soil. Our readings for shavings and pine straw for this period would indicate that.

"Chloride sampling for this period indicates that there has been a general rise in the chloride content for the Tamiami area; whereas for the Little River and Snake Creek canal areas the chloride content remained about what it had been the preceding period.

"There has been a little rise in the chloride content during this period for the Goulds and Military canals. During this period sampling of the North canal was included."

Drainage Studies - James Turnbull, Lake Alfred, Florida.-"Inspections were made of irrigated and unirrigated trees wherever it was possible to obtain side by side comparisons in an effort to evaluate the effect of irrigation on the ability of the tree to withstand cold damage. Such comparisons were found in four groves.

"With respect to orange trees, no difference could be found in the effect of the cold weather. With grapefruit, however, the damage to the irrigated groves was more severe than the damage to unirrigated groves. Time of irrigation seemed to be unimportant since damage to irrigated trees was found on groves irrigated only 10 days before the freeze as well as on groves irrigated a month before the freeze.

"The damage to the irrigated grapefruit trees was noticeable in the splitting of the bark on the limbs. In some instances the bark on limbs up to 2 inches in diameter was split on irrigated trees while unirrigated trees immediately adjacent showed no splitting.

"Comparisons of trees where severe defoliation of both irrigated and unirrigated trees occurred showed splitting of the bark on the irrigated trees but none on the unirrigated trees although relatively severe damage to the wood occurred on irrigated trees which showed only slight damage to the leaves. In the light of this information it seems advisable to limit winter irrigation to the minimum except in very warm areas or where protection from damage can be obtained from grove heating."

Drainage Studies - E. G. Diseker, Raleigh, North Carolina.-"The construction of the culvert has been started at the north end of Plot C, Plymouth Experiment. This will convey runoff water across the canal road to McRae canal. Hub stakes have been set and survey completed for the construction of culverts at the north end of Plots D and E, for the same purpose. Two corrugated, galvanized road culverts 12 inches in diameter and 12 feet long, have been secured for connecting two of the tile mains to the McRae Canal. The use of these will eliminate the necessity of head walls. Considerable difficulty was encountered in locating these culverts and the above size was the smallest size located.

"A silt basin has been constructed in the tile main outlet, as indicated on the map of the Bethel Experiment. A 6-inch reinforced concrete bottom was poured in place. The walls are made of concrete blocks. The inside dimensions of the basin are 4 feet x 4 feet, and it is 8 feet deep from the inner bottom to the top. The bottom is 20 inches lower than the tile line and the top is 18 inches above the ground surface. Approximately 50 feet of 8-inch terra cotta has been laid to grade leading from the silt basin, and 35 feet has been laid leading to the basin in order not to have a delay of considerable hand work when the trenching machine arrives. All joints were caulked, cemented, and the trenches back-filled, except a few feet on the outer ends where lines will be tied in. This was accomplished the last week in February. Reports are that it will be about March 20, before the trenching machine will be available for installing the remainder of the terra cotta."

Drainage Studies - I. L. Saveson, Baton Rouge, Louisiana.-  
 "Drawbar tests were run this past month on the effect of water lubrication on drawbar horsepower required for pulling mole machine. The following is the result of these tests:

Table 1.--Drawbar dynamometer tests

	Non-lubricated		Water lubricated		Reduction		
	Lbs. Pull	H.P.	Lbs. Pull	H.P.	Lbs. Pull	H.P.	% H.P.
							Percent
Max.	10,800	32.98	8,400	25.65	2,400	7.33	22
Avr.	9,000	27.5	6,900	21.07	2,100	6.4	23.27

"You will note that we have approximately 22 percent reduction in horsepower required and a reduction of 2,400 lbs. drawbar pull. In order to make water lubrication of the blade practical we will probably have to do some other work, since the present set-up uses considerable water. The pump we were using developed only a maximum of 30 lbs. pressure, thus requiring large perforation in mole blade and point. It is felt here at the project that if a pump of higher pressure were used we could reduce the size of the opening and the amount of water required."

Drainage Studies - W. J. Liddell, Athens, Georgia.-"Conferences were held with Dr. J. H. Miller of the Plant Pathology Department in the College to discuss and formulate plans for the use of the new chemical D-D in controlling nematodes on the vegetable plots in the coming year. Nematodes had adverse effect on production last year, and obviously before the results of irrigation can be evaluated it will be necessary to control the wide variations caused by nematode damage. A split-plot type of experiment has been planned which will not only improve the original information desired from irrigation studies, but will also give the results of nematode control measures, which is of primary interest to the Plant Pathology Department.

"Low spots near the end of the main and at the edge of the vegetable plots were often waterlogged last season from excessive rains and irrigation. A drain tile is being installed to carry subsurface water from this area to a drain ditch in the field. This month the grade stakes were set after a profile was run. Digging was about half completed, being delayed by bad weather.

"To prevent possible outside infection of nematodes, tomato seed were planted in soil from uncontaminated areas which was put into flats; these seed were germinated in the basement of Barrow Hall, and plants will not be exposed to nematode infestation until time for field planting."



## IRRIGATION DIVISION

### Hawaii Water-Law Study - Wells A. Hutchins, Berkeley, Calif.-

"Word has come from the Board of Water Supply, Honolulu, that a ground-water control bill will be introduced in the current session of the Hawaii Legislature, which convened February 19. So far, it is not known whether my services in assistance to the legislature will be required. If they are required, I shall undertake the assignment, as authorized by the cooperative agreement between the Board of water Supply and the Department of Agriculture, and as approved by Mr. Clyde in a memorandum dated February 20, 1947.

"Distribution of my printed report entitled, 'The Hawaiian System of Water Rights' has apparently begun, although I have as yet received only one copy. I am asking the Board of Water Supply to furnish a copy to various members of the Division of Irrigation and Water Conservation."

Snow Surveys - Willis C. Barrett, Logan, Utah.-"The snowmobile was tested under field conditions in deep, soft snow with the following results:

- a. Flotation characteristic satisfactory. Front ski can be improved by a more gradual turn up in front.
- b. Tracks performed excellently. They did not slip on steep side hills and gave good traction.
- c. The machine appeared to back satisfactorily over any distance and under any tested conditions, some rather severe. It was very stable and when badly tilted in several serious snow and slope conditions it was very easily righted.
- d. Its gear ratios are unsatisfactory. The machine travels too fast. They should be reduced by 50 percent. Under this condition it should go where no machine has yet been able to go."

Inventory of Water Resources in California - Paul A. Ewing, Berkeley, California.-Preliminary work has been done to inventory water resources in California, requested by Operations. Paul Ewing reports that work already done indicates the desired information is available in several Federal and State offices. "The California Public Utilities Commission, Districts Securities Commission, Division of Water Resources, and the Federal Land Bank of Berkeley all have files in good order which promise to supply the needed data. A short field trip to round the information obtained from these files may be all the travel needed."



Water Forecasting - W. T. Frost, Medford, Ore.-"Improved forecast correlations have been prepared for certain streams carrying water supplies to the Rogue River Valley.

"Additional studies of snow-runoff relations in the head of the Deschutes River are being made to improve and extend our forecasts for that area."

D. K. Fuhriman, Logan, Utah.-"Snow surveys made during the forepart of February over the State of Utah indicated a favorable water supply in prospect for most sections of the State. However, February brought unusually light precipitation and there are some areas of the State which may have a sub-normal water supply during the coming season. Early reports of March snow conditions over the State further indicate this possibility unless the coming 60 days bring considerable precipitation. Preliminary studies on extension of snow-cover correlations for streams of the State not now being forecast are progressing satisfactorily."

C. E. Houston, Reno, Nev.-"Midseason indications point to a continuation of the drought in Arizona; in fact, there are possibilities of much worse conditions than existed last year.

"A new form of Snow Survey Bulletin is a possibility for Nevada this coming spring. Work is progressing on bringing data up to date and setting up the new form."

James C. Marr, Boise, Idaho.-"The snow pack in the southern section of Columbia Basin greatly deteriorated during February, thereby making the water-supply outlook less encouraging than at earlier dates during the winter."

Water Supply - Dean C. Muckel, Pomona, Calif.-"A report entitled 'The Water Supply of the Escondido Soil Conservation District' was completed in provisional draft. Mr. J. B. Dixon, President of the District had asked for permission to review the report and circulate it among the district directors prior to submitting the report in final form. A copy was also sent to the Escondido Mutual Water Company with whom we are co-operating so that the manager and their consulting engineer can review it.

"In the report, the safe yield of the ground-water supplies of the Escondido valley was estimated to be 2,400 acre feet per year. The safe yield was based on the requirement that the water supply be firm, with no deficiencies occurring during the driest period on record. By this reasoning it is realized that surplus water will exist during wetter periods and that wastes will occur. However, for the type of agriculture and apparent trend towards a rural residential area it seems proper to follow this line of thought. Domestic, municipal, and orchard users of water are not inclined to cope with a shortage of water, even during the driest

periods. The quality of the ground water over most of the area was found to be unsuited for the Escondido soil conditions. Its use is permissible for citrus and avocados only in exceptionally well-drained soils--a condition that does not exist in the Escondido area. The water can, however, be mixed with imported water and used with safety.

Stream Flow Forecasting - R. L. Parshall, Fort Collins, Colo.-"Time has been given to the development of forecast curves covering several streams, particularly the Colorado River, Arkansas, Little Snake, and other streams.

"Efforts are being made to crystallize the program for the coming Los Angeles meeting of the Colorado River Water Forecast Committee next April. In planning this program it was first thought that it would be possible to have individual forecasts made of the several tributaries to the river. These forecasts would be analyzed and compared with the forecasts to be made of the main stream at Bright Angel for the summer filling of Lake Mead. So far, I have made little or no progress in this idea because the engineers of the Water Department of Los Angeles and the Southern California Edison Company, who have been vitally interested in the previous meetings of this Committee, now feel they have no time to devote to these several forecast problems."

Irrigation and Drainage in Imperial Valley - Harry F. Blaney, Los Angeles, Calif.-A report on irrigation and drainage in the Imperial Valley is now being prepared. The preliminary draft will be completed by March 7.

Formula for Flow of Water in Pipes - Fred C. Scobey, Berkeley, Calif.-Text of a paper is in preparation on a "General Formula for Flow of Water in Pipes." Before completion a complete recheck will be made of several hundred observations forming the basic material.

Manuscripts on Permeability and Canal Lining - C. W. Lauritzen, Logan, Utah.-"Data are being reviewed and assembled in the form of a manuscript entitled 'Specific Volume and Shrinkage Characteristics of Soil Material.' Also, a manuscript entitled 'Canal Lining Investigations' has been prepared and submitted to Washington preparatory to publication."

Infiltration Tests - Stephen J. Mech, Prosser, Wash.-"The striking influence of crop and crop sequence on the rate at which irrigation water is taken up by the soil is shown by the following two tables of data. Since the rate at which the soil takes up irrigation water represents also the smallest practicable irrigation head that must be used on the field, the wide variation in the irrigation head that is required during the

course of an alfalfa-row crop rotation is quite obvious.

Influence of crop on infiltration

	<u>Inches Per Hour</u>	
	<u>2% Furrow Grade</u>	<u>7% Furrow Grade</u>
Row crop - 10 years out of alfalfa	0.26	0.14
First year alfalfa - fall seeded	.32	.17
Old alfalfa - three years old	.60	.49

"Ten other plots cropped to potatoes for three consecutive years following the turning under of old alfalfa illustrate the residual influence of alfalfa on infiltration.

	<u>Infiltration Rate</u> <u>Inches per hour</u>
Potatoes - first year out of alfalfa	0.33
Potatoes - second year out of alfalfa	0.16
Potatoes - third year out of alfalfa - preceded by rye as green manure	0.20

"The above infiltration data show that a field first year out of alfalfa has irrigation characteristics considerably different from those during the preceding year or those expected the following year.

"Some indication of the erosion hazard during the course of a rotation may be obtained from the same data since the necessary irrigation head reflects the infiltration rate of the soil."

Seepage Studies - Carl Rohwer, Fort Collins, Colo.--"Revised mathematical analysis of principles governing measurement of seepage with seepage cup permeameter based on elevation of zero seep from permeameter in accordance with suggestions of Dr. Israelsen. The new analysis shows the relation to Darcy's law more clearly. Continued work on the revision of the first draft of the Seepage report."



Cooperative Study of Utah Drainage Districts - J. Howard Maughan, Logan, Utah.-"This project is being carried out in two principal divisions:

- a. The institutional phase, including district organization, services performed, legal requirements, and financial aspects;
- b. Study of the drains--their installation, operation and maintenance, and the results of drainage--in the 38 organized districts of the state.

"Much of the field work has been done and some preliminary findings of the study will soon be available for reporting. Compiling of some additional information on the institutional phase remains to be done for various districts. Further observation of the drains in all districts will be made during the forthcoming irrigation season. It is expected that findings of the study will be published in a bulletin to be issued by the Utah Agricultural Experiment Station about the end of 1947."

3/28/47

